AMENDMENTS TO THE CLAIMS:

This listing of the claims will replace all prior versions, and listings, of the claims in this application.

Claims 9-24 are herein canceled without prejudice or disclaimer.

Claims 25-40 are newly added.

Listing of Claims:

1. (Currently Amended) A method to determine information indicative of at least one property of a physical entity by utilizing a linear system of equations to represent the physical entity, the method comprising:

generating a mesh representation of the physical entity, wherein the mesh representation comprises a plurality of mesh elements;

computing a linear system matrix A of coefficients by computing interactions between simple functions defined over sets of mesh elements;

partitioning the mesh representation into a plurality of partitions separated by partition boundaries, wherein each partition comprises at least one mesh element of the plurality of mesh elements, wherein at least one partition comprises at least two mesh elements of the plurality of mesh elements;

computing, using at least the plurality of partitions, a preconditioner for the linear system matrix A, wherein the preconditioner is compatible with the linear system of equations and provides at least basis function support over at least two mesh elements, where coupling of the preconditioner between partitions is only through basis functions at the partition boundaries;

using at least the linear system matrix A and the preconditioner, determining an approximate numerical solution of the linear system of equations, wherein the approximate numerical solution comprises the information indicative of at least one property of the physical entity, wherein the at least one property comprises ~~one of~~ a fluid mechanical

property~~, an acoustical property or a field scattering property of a radar-related component~~; and

outputting the approximate numerical solution.

2. (Previously Presented) A method as in claim 1, where the preconditioner is itself a valid solution to a same set of physical equations that govern the full linear system of equations.

3. (Original) A method as in claim 1, where computing a preconditioner operates to compute a preconditioning matrix K where partition boundaries are constrained to coincide with the edges of mesh elements, and to compute mesh element interactions using reduced coupling.

4. (Original) A method as in claim 3, where mesh element interactions between basis functions are computed only for half functions within the same partition, where a half function denotes the function over any one of multiple mesh elements for which it is defined, and where the interactions of basis functions crossing a partition boundary are computed separately for each of the half functions such that no interactions exist between basis function halves that are defined in separate ones of the partitions, and those basis functions completely within a partition, referred to as interior elements, interact only with other interior elements and with boundary element halves within the same partition.

5. (Original) A method as in claim 4, further comprising sorting indices of basis functions in the matrices A and K so that all internal elements appear first, grouped according to their respective partitions, followed by all boundary elements, and where a resulting preconditioning matrix K for n partitions has the form:

$$K = \begin{bmatrix} [Ka_1] & & & & \\ & [Ka_2] & & & [Kb] \\ & & \ddots & & \\ & & & [Ka_n] & \\ & [Kc] & & & [Kd] \end{bmatrix},$$

where the sub matrix Ka is the block diagonal matrix created by the union of the matrices of internal element interactions Ka_1 through Ka_n, Kd represents the interactions between the boundary elements, and Kb and Kc are the interactions between the internal and boundary elements.

6. (Previously Presented) A method as in claim 5, wherein determining an approximate numerical solution further comprises iteratively solving a system of equations $Ax=f$ using the linear system matrix A, a vector f of boundary conditions on each mesh element and the preconditioner matrix K to provide an approximate solution x.

7. (Original) A method as in claim 6, where the linear system matrix A is partitioned in the same manner as the preconditioner using the same partitions, separate partitions, or a combination of the same and separate partitions.

8. (Original) A method as in claim 6, where iteratively solving comprises operating a conjugate gradient iterative solver.

9-24. (Canceled)

25. (New) A method to determine information indicative of at least one property of a physical entity by utilizing a linear system of equations to represent the physical entity, the method comprising:

generating a mesh representation of the physical entity, wherein the mesh representation comprises a plurality of mesh elements;

computing a linear system matrix A of coefficients by computing interactions between simple functions defined over sets of mesh elements;

partitioning the mesh representation into a plurality of partitions separated by partition boundaries, wherein each partition comprises at least one mesh element of the plurality of mesh elements, wherein at least one partition comprises at least two mesh elements of the plurality of mesh elements;

computing, using at least the plurality of partitions, a preconditioner for the linear system matrix A, wherein the preconditioner is compatible with the linear system of equations and provides at least basis function support over at least two mesh elements, where coupling of the preconditioner between partitions is only through basis functions at the partition boundaries;

using at least the linear system matrix A and the preconditioner, determining an approximate numerical solution of the linear system of equations, wherein the approximate numerical solution comprises the information indicative of at least one property of the physical entity, wherein the at least one property comprises an acoustical property; and

outputting the approximate numerical solution.

26. (New) A method as in claim 25, where the preconditioner is itself a valid solution to a same set of physical equations that govern the full linear system of equations.

27. (New) A method as in claim 25, where computing a preconditioner operates to compute a preconditioning matrix K where partition boundaries are constrained to coincide with the edges of mesh elements, and to compute mesh element interactions using reduced coupling.

28. (New) A method as in claim 27, where mesh element interactions between basis functions are computed only for half functions within the same partition, where a half function denotes the function over any one of multiple mesh elements for which it is defined, and where the interactions of basis functions crossing a partition boundary are computed separately for each of the half functions such that no interactions exist between basis function halves that are defined in separate ones of the partitions, and those basis functions completely within a partition, referred to as interior elements, interact only with other interior elements and with boundary element halves within the same partition.

29. (New) A method as in claim 25, further comprising sorting indices of basis functions in the matrices A and K so that all internal elements appear first, grouped according to their

respective partitions, followed by all boundary elements, and where a resulting preconditioning matrix K for n partitions has the form:

$$K = \begin{bmatrix} [Ka_1] & & & & \\ & [Ka_2] & & & \\ & & \ddots & & [Kb] \\ & & & [Ka_n] & \\ & [Kc] & & & [Kd] \end{bmatrix},$$

where the sub matrix Ka is the block diagonal matrix created by the union of the matrices of internal element interactions Ka_1 through Ka_n, Kd represents the interactions between the boundary elements, and Kb and Kc are the interactions between the internal and boundary elements.

30. (New) A method as in claim 29, wherein determining an approximate numerical solution further comprises iteratively solving a system of equations $Ax=f$ using the linear system matrix A, a vector f of boundary conditions on each mesh element and the preconditioner matrix K to provide an approximate solution x.

31. (New) A method to determine information indicative of at least one property of a physical entity by utilizing a linear system of equations to represent the physical entity, the method comprising:

generating a mesh representation of the physical entity, wherein the mesh representation comprises a plurality of mesh elements;

computing a linear system matrix A of coefficients by computing interactions between simple functions defined over sets of mesh elements;

partitioning the mesh representation into a plurality of partitions separated by partition boundaries, wherein each partition comprises at least one mesh element of the plurality of mesh elements, wherein at least one partition comprises at least two mesh elements of the plurality of mesh elements;

computing, using at least the plurality of partitions, a preconditioner for the linear system matrix A, wherein the preconditioner is compatible with the linear system of

equations and provides at least basis function support over at least two mesh elements, where coupling of the preconditioner between partitions is only through basis functions at the partition boundaries;

using at least the linear system matrix A and the preconditioner, determining an approximate numerical solution of the linear system of equations, wherein the approximate numerical solution comprises the information indicative of at least one property of the physical entity, wherein the at least one property comprises a field scattering property of a radar-related component; and

outputting the approximate numerical solution.

32. (New) A method as in claim 31, where the preconditioner is itself a valid solution to a same set of physical equations that govern the full linear system of equations.

33. (New) A method as in claim 31, where computing a preconditioner operates to compute a preconditioning matrix K where partition boundaries are constrained to coincide with the edges of mesh elements, and to compute mesh element interactions using reduced coupling.

34. (New) A method as in claim 33, where mesh element interactions between basis functions are computed only for half functions within the same partition, where a half function denotes the function over any one of multiple mesh elements for which it is defined, and where the interactions of basis functions crossing a partition boundary are computed separately for each of the half functions such that no interactions exist between basis function halves that are defined in separate ones of the partitions, and those basis functions completely within a partition, referred to as interior elements, interact only with other interior elements and with boundary element halves within the same partition.

35. (New) A method as in claim 31, further comprising sorting indices of basis functions in the matrices A and K so that all internal elements appear first, grouped according to their respective partitions, followed by all boundary elements, and where a resulting preconditioning matrix K for n partitions has the form:

$$K = \begin{bmatrix} [Ka_1] & & & & \\ & [Ka_2] & & & \\ & & \ddots & & [Kb] \\ & & & [Ka_n] & \\ & [Kc] & & & [Kd] \end{bmatrix},$$

where the sub matrix Ka is the block diagonal matrix created by the union of the matrices of internal element interactions Ka_1 through Ka_n, Kd represents the interactions between the boundary elements, and Kb and Kc are the interactions between the internal and boundary elements.

36. (New) A method to determine information indicative of at least one property of a physical entity by utilizing a linear system of equations to represent the physical entity, the method comprising:

generating a mesh representation of the physical entity, wherein the mesh representation comprises a plurality of mesh elements;

computing a linear system matrix A of coefficients by computing interactions between simple functions defined over sets of mesh elements;

partitioning the mesh representation into a plurality of partitions separated by partition boundaries, wherein each partition comprises at least one mesh element of the plurality of mesh elements, wherein at least one partition comprises at least two mesh elements of the plurality of mesh elements;

computing, using at least the plurality of partitions, a preconditioner for the linear system matrix A, wherein the preconditioner is compatible with the linear system of equations and provides at least basis function support over at least two mesh elements, where coupling of the preconditioner between partitions is only through basis functions at the partition boundaries;

using at least the linear system matrix A and the preconditioner, determining an approximate numerical solution of the linear system of equations, wherein the approximate numerical solution comprises the information indicative of at least one property of the physical entity, wherein the at least one property comprises an electromagnetic property of a printed circuit board; and

outputting the approximate numerical solution.

37. (New) A method as in claim 36, where the preconditioner is itself a valid solution to a same set of physical equations that govern the full linear system of equations.

38. (New) A method as in claim 36, where computing a preconditioner operates to compute a preconditioning matrix *K* where partition boundaries are constrained to coincide with the edges of mesh elements, and to compute mesh element interactions using reduced coupling.

39. (New) A method as in claim 38, where mesh element interactions between basis functions are computed only for half functions within the same partition, where a half function denotes the function over any one of multiple mesh elements for which it is defined, and where the interactions of basis functions crossing a partition boundary are computed separately for each of the half functions such that no interactions exist between basis function halves that are defined in separate ones of the partitions, and those basis functions completely within a partition, referred to as interior elements, interact only with other interior elements and with boundary element halves within the same partition.

40. (New) A method as in claim 36, further comprising sorting indices of basis functions in the matrices A and K so that all internal elements appear first, grouped according to their respective partitions, followed by all boundary elements, and where a resulting preconditioning matrix K for n partitions has the form:

$$K = \begin{bmatrix} [Ka_1] & & & & \\ & [Ka_2] & & & \\ & & \ddots & & [Kb] \\ & & & [Ka_n] & \\ & [Kc] & & & [Kd] \end{bmatrix},$$

where the sub matrix Ka is the block diagonal matrix created by the union of the matrices of internal element interactions Ka_1 through Ka_n, Kd represents the interactions between the boundary elements, and Kb and Kc are the interactions between the internal and boundary elements.